

2.8: Units Raised to a Power

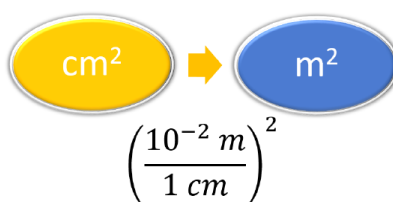
Learning Objectives

- To convert a value reported in one unit raised to a power of 10, to a corresponding value in a different unit raised to the same power of 10, using conversion factors.

Conversion factors for area and volume can also be produced by the dimensional analysis method. Just remember that if a quantity is raised to a power of 10, both the number and the unit must be raised to the same power of 10. For example, to convert 1500 cm^2 to m^2 , we need to start with the relationship between centimeter and meter. We know that $1 \text{ cm} = 10^{-2} \text{ m}$ or $100 \text{ cm} = 1 \text{ m}$, but since we are given the quantity in 1500 cm^2 , then we have to use the relationship:

$$1 \text{ cm}^2 = (10^{-2} \text{ m})^2 = 10^{-4} \text{ m}^2$$

CONCEPT MAP



To convert centimeters squared to meters squared, use the conversion factor 0.01 meters per 1 centimeter, squared overall

CALCULATION

$$1500 \text{ cm}^2 \times \left(\frac{10^{-2} \text{ m}}{1 \text{ cm}} \right)^2 = 0.15 \text{ m}^2$$

or

$$1500 \text{ cm}^2 \times \left(\frac{1 \text{ m}}{100 \text{ cm}} \right)^2 = 0.15 \text{ m}^2$$

or

$$1500 \text{ cm}^2 \times \frac{1 \text{ m}^2}{10,000 \text{ cm}^2} = 0.15 \text{ m}^2$$

✓ Example 2.8.1: Volume of a Sphere

What is the volume of a sphere (radius 4.30 inches) in cubic cm (cm^3)?

Solution

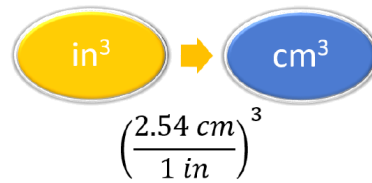
Solution for Example 2.8.1

Steps for Problem Solving	What is the volume of a sphere (radius 4.30 inches) in cubic cm (cm^3)?
Identify the "given" information and what the problem is asking you to "find."	Given: radius = 4.30 in Find: cm^3 (volume)
Determine other known quantities.	Volume of a sphere: $V = \frac{4}{3} \times \pi \times r^3$ $= \frac{4}{3} \times 3.1416 \times (4.30 \text{ in})^3$ $= 333.04 \text{ in}^3$

Steps for Problem Solving

What is the volume of a sphere (radius 4.30 inches) in cubic cm (cm^3)?

Prepare a concept map.



To convert inches cubed to centimeters cubed, use conversion factor 2.54 centimeters per 1 inch, cubed overall

Calculate.

$$333.04 \text{ in}^3 \left(\frac{2.54 \text{ cm}}{1 \text{ in}}\right)^3 = 5.46 \times 10^3 \text{ cm}^3$$

Think about your result.

A centimeter is a smaller unit than an inch, so the answer in cubic centimeters is larger than the given value in cubic inches.

? Exercise 2.8.1

Lake Tahoe has a surface area of 191 square miles. What is the area in square km (km^2)?

Answer

495 km^2

Contributions & Attributions

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